Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/433
JAPAN
February 1964
Submitted in:
ENGLISH and FRENCH

Confidential until official release during Conference

Abstract

COMMERCIAL TECHNICAL METHODS FOR ENRICHMENT AND PURIFICATION OF DEGRADED AND CONTAMINATED HEAVY WATER FOR NUCLEAR REACTORS

Susumu Sonoda and Yasuo Kurihara, Showa Denko K.K.
Takeichiro Takamatu, Kyoto University
Tokuyoshi Morita, Nagoya University

Development research on heavy water reactors has been conducted in Canada, France, the United States, the United Kingdom, the Soviet Union, Sweden, etc., which has induced the economy of the heavy water reactor to be reviewed with renewed interest in recent years. Heavy water in a reactor is reduced in concentration or subject to contamination depending on the handling conditions. Economical enrichment and refinement of heavy water is a vital question in connection with the operation of heavy water reactors.

We made pilot plant tests on the non-diaphragm electrolysis process with special recovery apparatus, and the rectification process, and established new, workable techniques in both processes. We have completed new technology including necessary conditions to scale up apparatus (Japanese Patent No. 256416, Japanese Utility Models No. 714723 and No. 714724), the optimum cascade theory and economic evaluation. These processes are indispensable to improve the economy of the heavy water reactor. To prevent contamination and degradation of heavy water in treatment, the gas circulation and recovery system is of special design. The operating condition is very safe and the yield is about 100%. The distillation process consists of a sieve plate tower. The design is based on the ideal cascade theory, and the operation cost is very low. Domestically, we have rendered appreciable service in the operation of JRR-2 and JRR-3 of the Japan Atomic Energy Research Institute. New economic reconcentration and regeneration of heavy water is being carried out with a 5 T/Y plant.

The present report contains results of such experiment and design calculation as to a 30 T/Y plant capable of treating larger quantities of

heavy water. It also acknowledges that the aforesaid electrolysis process is economically advantageous for a capacity of less than 5 T/Y and that the rectification process for a higher capacity.

As to removal of impurities in heavy water, including oil and soluble ion, we have gained experience in highly efficient rectification by operating a pilot plant. We feel that we have established a low cost process for regenerating heavy water which has been used in a reactor.